



Journal of Education for Humanities

A peer-reviewed quarterly scientific journal issued by College of Education for Humanities / University of Mosul



Metathesis as a Simplification Process in Child Phonology: A Cross- Linguistic Study

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Article information

Received : 15/4/2026

Revised 18/5/2026

Accepted : 24/5/2026

Published 1/9/2026

Keywords:

Metathesis, Phonological Development, Simplification Processes, Speech Perception, and Cross-Linguistic Study

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Abstract

The nature of metathesis in early childhood speech is investigated in this study through a cross-linguistic analysis of spontaneous data from Mosuli Arabic and Bahdini Kurdish preschool children, supplemented by English data drawn from the literature. The analysis identifies systematic patterns of segmental transposition and evaluates them against key phonological and perceptual criteria, including the Syllable Contact Law, place feature redistribution, phonological analogy, and the attestation of resultant forms in adult phonology. Findings indicate that metathesis functions as a simplification process in child language, shaped by both articulatory ease and perceptual limitations. Children appear to reorder segments not randomly, but in ways that produce structurally preferred and perceptually accessible outputs. The study concludes that a comprehensive account of metathesis must consider the interplay of production constraints, perceptual processing, and language-specific phonological patterns. These insights contribute to a broader understanding of the mechanisms underlying phonological development across languages.

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مجلة التربية للعلوم الإنسانية

مجلة علمية فصلية محكمة، تصدر عن كلية التربية للعلوم الإنسانية / جامعة الموصل



الإبدال الصوتي كعملية تبسيط في النظام الصوتي التطوري للأطفال:

دراسة لغوية مقارنة

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ملخص	معلومات الارشفة
تهدف هذه الدراسة إلى دراسة طبيعة الإبدال الصوتي في كلام الأطفال من خلال تحليل لغوي مقارنة لبيانات جمعت من كلام أطفال دون سن المدرسة من الناطقين للغتين العربية الموصلية والكردية البهيدنية، بالإضافة إلى بيانات من اللغة الإنكليزية مأخوذة من دراسات سابقة. وقد تمّ تحديد أنماط منتظمة من تبديل المواقع الصوتية وتقييمها بناءً على معايير صوتية وإدراكية، مثل قانون تتابع المقطع، وإعادة توزيع الصفات المكانية، والقياس الفونولوجي، وتوافق الصيغ الناتجة مع النظام الصوتي للكبار. تشير النتائج إلى أن الإبدال الصوتي يعمل كعملية تبسيط في لغة الأطفال، تتشكل من خلال سهولة النطق والقيود الإدراكية في آنٍ واحد. ويبدو أن الأطفال لا يقومون بتبديل الأصوات عشوائياً، بل وفق أنماط تُنتج أشكالاً صوتية مفضلة من حيث البنية وسهولة من حيث الإدراك. وتخلص الدراسة إلى أن تفسير الإبدال الصوتي تفسيراً شاملاً يتطلب النظر في التفاعل بين قيود النطق، والمعالجة الإدراكية، والأنماط الصوتية الخاصة بكل لغة. وتساهم هذه النتائج في تعميق فهمنا للآليات التي تحكم تطور النظام الفونولوجي عبر اللغات	تاريخ الاستلام : 15/4/2026 تاريخ المراجعة : 18/5/2026 تاريخ القبول : 24/5/2026 تاريخ النشر : 1/9/2026 الكلمات المفتاحية : الإبدال الصوتي؛ التطور الصوتي للأطفال؛ عمليات تبسيط الكلام؛ الإدراك السمعي؛ دراسة لغوية مقارنة معلومات الاتصال انمار حمودي anmar.h.saeed@uomosul.edu.iq

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1. Introduction

Metathesis, the transposition or reversal of sounds within words, is remarkably observed in the speech of young children through their developmental stages of language acquisition. It is observed in the deformed pronunciation of preschool children, between ages 2 and 5 years where correct pronunciation is reported to occur thereafter. During this period, children's speech is said to go through a variety of simplification processes that include either the *deletion* of sounds or syllables or the *substitution* of sounds or features. Metathesis, however, differs in that both sounds are preserved, but they are only reversed or switched in position.

Metathesis is a relatively understudied process in child phonology compared to more common simplification strategies such as substitution and deletion (see among others, Younis, 2008; Gerlach, 2010; Betti & Igaab, 2019). Unlike these processes, metathesis preserves the original segments but alters their sequential order, raising questions about its phonological status. While some accounts treat metathesis as a simplification strategy, others attribute it to performance errors in speech planning or execution.

The organization of this paper is as follows. Section 2 provides an overview of the concept of metathesis in phonological theory. The aims and research questions of the study are presented in Section 3. Section 4 explains the methodology, data collection, and procedures employed in the study. Data analysis and results are presented in Section 5, followed by a discussion of the results in Section 6. Finally, Section 7 presents the conclusions reached by the study.

2. Metathesis in Phonological Theory

Metathesis, in segments, generally occurs when two sounds within a syllable or word are interchanged or placed in a different order. Trask (1996, p. 222), for example, defines metathesis as "an exchange in the positions of two segments in a word, either as a historical change or as a synchronic rule." In more technical terms, it is defined as "the reversal of the expected linear order of segments, which may affect contiguous segments (ask→aks) or non-contiguous segments (/leðurblokur/→ /leðurböklur /)" (Fukazawa & Miglio, 2008, p. 31).

Metathesis may involve units at the phonological level, consonants, vowels and syllables, as well as units at higher levels, linguistic level, e.g., words. Consonants or whole syllables of the target word are reordered in the child's production, e.g. Deborah: Rudolfo's [du'ralfoz] and Susie: xylophone --- ['zaɪɪfloʊn] (Vihman & Greenlee, 1987, p. 521; see also Blevins & Garrett, 2004). It has been observed by some researchers on Arabic, e.g. Al-Bamerni (1989, p. 20), that sound switching is pervasively observed

in consonants rather than in vowels which is reported to be rare. From long observation of different children, it is noticed that metathesis in children mainly affects consonants, never vowels.

Rose (2001, p. 484) looks at metathesis as “the reversal in the ordering of features found in the target word”, e.g., (duck /dʌk/ → /gʌt/) [CORONAL] vs. [NON-CORONAL]. According to him, metathesis takes place in child phonology to fit the rather different structure into an already existing one in the child's system. Thus, “all aspects of the representations are assumed to be provided by universal Grammar (UG) as part of the child's innate linguistic competence”. Williamson (2010) looks at metathesis as a simplification process that "occurs when two consonants within a syllable are placed in a different order." (p.3) According to him, metathesis is ascribed to the insufficient ability of young children "to fully co-ordinate the movements of their vocal apparatus. As a consequence, certain sounds, sound combinations and transitions from one sound to another may be currently too difficult." (p.3)

Some phonologists postulate that deviation attested in children's pronunciation is neither ascribed to problems in perception nor representation, but *rather*, to the children's lack of control over their production. Fikkert (2005), for example, assumes that "there is a single abstract phonological representation mediating between word recognition and production." (p.4), which explains the observation that children are able to recognize the unmetathesized words when they are uttered although they themselves pronounce them differently.

2.1. Characteristics of Simplification in Child Phonology

In the course of acquiring the native language, a child's speech deviates from an adult's in a number of ways; this is ascribed to the child's application of a number of phonological processes. For some researchers, e.g. Ingram (1979) and Williamson (2010), a phonological process involves simplifying a structure, a word or a syllable, by deletion, reduction or substitution of a difficult sound by a simpler one involving less articulatory maneuvers. Such phonological processes are, generally, classified into two types: structural and systemic (Williamson, 2010).

Ingram (1979) provides a description of the phonological patterns reflected in the words used by children between ages 1.6 and 4.0 through establishing phonological processes, including substitution (stopping, fronting, gliding, vocalization, and vowel neutralization), assimilation processes (voicing, consonant harmony, progressive vowel assimilation), and syllable structure processes (cluster reduction, deletion of

final consonants, deletion of unstressed syllables, and reduplication). No mention has been made of metathesis as a phonological process. A number of other phonologists, e.g. Fikkert (1994), Rose (2001) and Williamson (2010), deal with it as a simplification process however.

Language acquisition is generally characterized by three different aspects: perception, representation, and production. A question that is raised at this point is: At which level do simplification processes take place? Most of the studies available in the literature assign a chief role to production, particularly to the difficulties of production, e.g., Ingram (1979) and Williamson (2010). However, others postulate that representation especially in early childhood plays a significant role in children's simplified speech, e.g., Fikkert (2005), Rose (2001) and Gerlach (2010). The role of perception has not fully been considered as crucial by many writers (but, cf. Fukazawa and Miglio, 2008).

According to Fikkert (2005) metathesis is a simplification process that produces the easier sequence for the child at early childhood between 1- 2 years (viz. 1;0- 1;7), e.g., "kip" / kip/ (chicken)→ [pik]. Fukazawa and Miglio (2008:32) argue that the occurrence of metathesis in child phonology produces universally unmarked patterns. Moreover, they interpret metathesis in children's speech as resulting from the misperception of acoustic signals. (see also Ploumudi, 2024).

However, Kiparsky (2017) offers a "partial explanation" for the variation that have been noticed between metathesis and other simplification processes like assimilation to stem from the motivation behind each: "metathesis is directed by perception, whereas assimilation is typically driven by production. Compared to perceptually-driven processes, articulatory-driven processes are typically more automatic and pervasive because they arise from physiological limitations on the vocal tract apparatus. Therefore, it is not unexpected to discover metathesis influencing only a limited portion of a certain phonological system, specifically consonants." In the course of this study, some light will be shed on the role of these different aspects in children's metathesis.

2.2 Characteristics of Metathesis in Child and Adult Phonologies:

All regular cases of synchronic metathesis strictly involve adjacent segments, i.e. single sounds (see Hume, 1998, Mielke and Hume, 2001 for related discussion). In adult phonology, metathesis may involve segments and syllables, unlike the case in child phonology where metathesis is restricted to segments only (Fukazawa and Miglio, 2008).

Hume (2004) assumes that synchronic metathesis (metathesis in adult phonology) “has its roots in speech processing.” The discovery that the sequences produced by metathesis fit into pre-existing patterns in the language provides some support for this theory. Further support for the idea that it is not desirable to reverse sounds at the start of a word or root comes from Mielke and Hume (2001), whose research relates to the impact of word recognition on cross-linguistic patterns of metathesis.

For a straightforward explanation of metathesis, Hume (2004) claims that two factors should be considered: the phonetic nature of the sounds and the shared knowledge between the speaker and hearer of their language sound patterns and the frequency of their occurrence. Both factors should be considered together. According to her, two requirements must be fulfilled for metathesis to take place: first, the acoustic signal must be indeterminate; second, the sequence of the metathesized sounds and the corresponding unmetathesized elements in the input must form an attested linguistic structure.

For the attestation factor, Hume (2004) shows that the native sound patterns strongly determine the nature of metathesis; hence the resulting structures are attested in the language; which means that metathesis is language specific. When the language contains both orders of sequences, "the listener will be biased towards the most robust sequence, that is, the one with the highest frequency" (p.221). Hume (2004, pp. 229-30) disclosed the factors that determine the occurrence of metathesis. She has demonstrated that when both universal and language-specific variables are taken into account, a cohesive and predictive account is possible. Language specificity arises from the impact of the speaker's or listener's understanding of the sound patterns on the language, whilst the universal component is based on the psychoacoustic characteristics of the sound combination in question and the situation in which it occurs.

Hume (2001, 2004) argues that synchronic metathesis is due to “indeterminacy”, which according to her, is a very influential factor. A situation known as "indeterminacy of order" occurs when there is not enough information available about the linear ordering of the constituent pieces (p. 216). The quality of information occurring in the speech signal (the types of sounds involved, the context in which the sounds occur, the phonetic cues available, etc.) and the listener's experience of the elements involved (e.g., sounds, sound sequences, morphemes, words, etc.) are thus the two factors that determine it.

In the literature, metathesis as a phonological process attested during language acquisition has received considerable attention from many researchers, as demonstrated by studies such as those of Khafidhoh (2019), Qasem (2023), and Ploumidi (2024). However, there is no consensus among researchers regarding the causes underlying the emergence and occurrence of metathesis or whether it should be regarded as a simplification process.

In this study, we focus on the attestation of the resulting sequences and the indeterminacy of acoustic signals as factors underlying the occurrence of metathesis in the speech of young children.

3. Aims and Research Questions

The current paper aims at investigating the status of metathesis as a simplification process by examining a corpus of data collected longitudinally from three Mosuli Arabic children, and from a cross-sectional observation of other children with a different first language, namely, Bahdini Kurdish⁽¹⁾; in addition to English data collected from available literature. The main focus is on metathesis in consonants rather than in vowels or consonants/vowels which are reported to rarely occur in children's speech (see for example, Smith, 1973).

This paper provides some insight into the relationship between a child's phonetic forms and phonological structures and those of an adult's system. In the literature on metathesis, in general and child phonology in particular a number of inquiries have been made about the status of metathesis, none of which however, has obtained a definite or conclusive answer.

The present research attempts to find answers to the following questions:

1. Is metathesis a simplification process?
2. What determines the switching of sounds?
3. Can metathesis patterns be set up similar to those of substitution and assimilation in child phonology?
4. Is metathesis a systematic process?
5. As a simplification process, does metathesis take place at the level of production, perception, or representation?

⁽¹⁾ For a general account on the Kurdish language and the Kurdish people, see Wikipedia at https://en.wikipedia.org/wiki/Kurdish_languages

4. Methodology:

A corpus of metathesized words has been collected from a number of preschool children with different first languages (L1): Arabic and Kurdish*. Three children, with Arabic L1, were observed longitudinally since the inception of their first metathesized words: N., a girl, 1.08 -7 years; A.W., a boy, 1.10 – 5 years; and M., a boy: 2.10- 5 years. The sum of the words collected constitutes a total of 226 word types. ⁽¹⁾

A different set of metathesized forms was cross-sectionally gathered from several Kurdish youngsters, either directly or indirectly through their parents and relatives. A corpus of English data from the literature was also utilized as an additional piece of evidence to enhance the discussion and analytical sample.

5. Data Analysis and Results

To examine the status of metathesis as a simplification process, the collected data were transcribed phonemically and were compared to adult speech. To proceed in data analysis a set of criteria was established, these included the following:

1. Patterns of metathesis, i.e. the location of the switched sounds within the word and/or the syllable.
2. Resulted sequences' admission to:
 - a. "The Syllable Contact Law (SCL)" introduced by Murray and Vennemann (1983) and Vennemann, (1988). According to this law, there is a cross-linguistic preference for syllable contacts to have a falling sonority slope. As claimed, the tendency of the switched sounds to metathesize is ascribed to the emergence of an unmarked sequence; one that is characterized by ease of pronunciation, and adherence to the sonority sequencing principle.
 - b. Place Feature Reordering. The reordering the consonants in a word is motivated by a certain principle which shifts a coronal consonant to the right of a non-coronal consonant (see Smith, 1973, p.100)
3. Occurrence of phonological analogy with pre-existing words in the language.
4. Attestation of the resultant sequences in adults' speech.

The words constituting the data were analysed into their constituent syllables. Both, the target and the metathesized sequences were compared to arrive at patterns of sound

⁽¹⁾ The children had either Mosuli Arabic (a form of Iraqi Arabic spoken in Mosul) for their L1, or Bahdini Kurdish (a form of Kurdish, also known as Northern Kirmanji, spoken in Duhok Governorate).

reversals in the different languages. The analysis revealed 7 patterns of metathesis to occur in the children's speech (See Table 1), the most frequent of which are CVC1. C2V → CVC2. C1V, C1V. C2V → C2V. C1V, and C1VC2 → C2VC.

Thus, taking the syllable structure into consideration, analyzing the speech of children reveals a good deal about the phonological changes that take place in their speech. This is due to the observation that several sound changes are strongly position sensitive (Locke, 1980, p.199).

Table 1: Percentages of Metathesis Patterns in the Data.⁽¹⁾

	Metathesis Patterns	No.	Percentages of Data from Arabic	No.	Percentages of Data from Kurdish
1	CVC1. C2V → CVC2. C1V	70	38.46%	18	46,15%
2	C1V. C2V → C2V. C1V	74	40.65%	8	20.51%
3	C1 VC2 → C2VC1	30	16.48%	9	23.07%
4	C1V(C). CVC2→C2V(C). CVC1	3	1.64%	3	7.69%
5	C1C2V → C2C1V	4	2.20%	-----	-----
6	C1V. CVC2 → C2V. CVC1	1	0.55%	-----	-----
7	C VC1C2 → CVC2C1	-----	-----	1	2.56%

⁽¹⁾ Instances that involve metathesis with geminated sounds (15 cases) are analyzed according to the permissible patterns of syllable in Arabic, viz. either as C1V. C2V → C2V. C1V or as C1 VC2 → C2VC1. Gemimates in Kurdish have been found to be rare.

Two types of metathesis were recognized according to the location of the switched sounds: local metathesis, which involves switching of adjacent consonants, e.g. CVC1. C2V and C1C2V, and long-distance metathesis, which influences consonants separated by one or more sounds/syllables, e.g. C1V. C2V and C1VC2 (see Buckley, 2011 and Gerlach, 2010). Our data reveal that only 93 out of 228⁽¹⁾ metatheses display local metathesis; all the other forms represent long- distance metathesis.

According to the “Syllable Contact Law”, the greater the sonority drop between coda and the following onset, the more harmonic the relationship between them.” (Murray Venneman, 1983) Examining the data in the light of the "Syllable Contact Law", which applies only to metathesis instances where switching involves consonants in the onset and coda of the syllable, two patterns demonstrated this kind of switching: CVC1. C2V and C1VC2. Thus, metathesis may result in a structure (sequence) that better conforms to the sonority principle. For example, 'breakfast' /'brekfəst/ → /'brefkəst/, where 'fk' more closely adheres to the sonority sequencing principle than 'kf', since /f/ is more sonorous than /k/. Only 41 instances out of 78 (i.e., 52.56%) metatheses in our data from Arabic and 13 out of 23 (i.e., 56.52%) from Kurdish showed conformance to the Syllable Contact Law; whereas 47 forms from both languages (37 from Arabic and 10 from Kurdish) did not conform to this law, and 125 instances reflected null change (examples 1. a, b, and c respectively).

(1)

- a.** /labsi:ni:/ (You dress me up) → / balsi:ni: /
/ ʃaʦfi:ni:/ (You wash me) → /ʃafti:ni:/
/nastala / (chocolate) → / tansala /
/səɖʒne/ (Kurdish: prison) → /səndʒe/
/maqlu:bi/ (Kurdish: traditional food) → /malbu:qi/

- b.** /ʃo:rba/ (soup) → /ʃo:bla/
/χa:wli:/ (towel) → /χa:lwi:/
/ ʔalqa / (bullet) → / ʔaqla /
/tizbi:/ (Kurdish: rosary) → /tibzi:/
/mazalke/ (Kurdish: room) → /malazke/

⁽¹⁾ Six other words in the data haven't been given in Table 1 involve complex sound switching in that more than one switching of sounds takes place at the same time, e.g., /ʃajjifqisa/ (He is switching it off) → / ʃajjiqsifa/, /zala:bja/ (waffle) → /baza:lja/ (peas).

- c. /maḥbas/ (ring) → /masbaḥ /
 /jihfað / (keep safe) → /jifhað /
 /tikṭibi:n / (You, fem., write) → /tikḃiti:n /
 /χotba/ (Kurdish: week/ the Friday ceremony) → /χobta/
 /nasa:χ/(Kurdish: ill/ sick) → /naχa:s/

Analogy is defined as the " process by which a form or pattern is altered so as to conform to another form or pattern existing in the language." (Trask, 1996:23) (cf. Hume's 2001 generalization factor). Phonological analogy is used as a criterion in this research to examine metathesis patterns in the data. It was found in 51 examples (out of 187), in the data from Arabic, i.e. 27.27%; and 5 examples (out of 39) in the data from Kurdish, i.e. 12.82%:

(2)

- /maḥbas/ (ring)→ /masbaḥ/ (swimming pool),
 /naʃʃaftu:/ (I dried it) → / naffaʃtu: / (I fluffed it up),
 / baṭṭa/ (duck) → / ṭappa / (ball),
 / ʔaʃʕəla / (I burn it) → / ʔaʃlaʕa/ (I rip it off),
 / ṭalqa/ (bullet) → / taqla / (flip).
 /rəbəʕ/ (Kurdish: quarter) → /rəʕəb/ (horror)
 /tibl/ (Kurdish: finger) → /tilb/ (in Kurdish, this is close to the word 'tilp', "clumsy").

The phonetic similarity of a word with another has a great influence on the process of segment reversal; hence "... most anticipations, preservations and reversals of phonetic segments occur in phonetic environments that are identical or nearly identical" (Clark and Clark, 1979, p. 282). Hume (2001) uses the term "generalization" to refer to this tendency. Generalization thus refers "to the tendency to simplify representations relative to the sensory reality experienced" (p.6), which brings to light the concept of *phonological neighbourhood*. Studies on child phonology have shown that *phonological neighborhood density*, which refers to the number of words that differ from a target word by a single phoneme, can affect speech production (see, for example, Hume, 2007, Munson and Solomon, 2004, and Vitevitch and Luce, 2016).

For some phonologists, like Smith (1973), and Rose (2001), metathesis involves the redistribution of consonants to achieve a preferred place feature. Grammont (1939, cited in Hume, 2001, p.11) claims that in synchronic metathesis, the linear ordering of two consonants may change so that the more posterior articulation precedes the more

anterior one. Thus, a sequence of [coronal] + [dorsal] is switched to a [dorsal] + [coronal], or more generally, a [coronal]+ [non-coronal] into a [non-coronal] + [coronal]. This claim has been confirmed by evidence from cases of dialectal variation and child language. From Smith's (1973), 10 out of 12 examples of metathesis demonstrate adherence to the place feature principle.

Examples:

(3)

"alligator" /æləgeɪtə/ → /æɡəleɪtə/,
"bicycle" /baɪsəkəl/ → /baɪkəsəl/,
"miserable" /mɪzrəbl/ → /mɪzbərəl/.

By examining the data in our study, we found 83 instances out of 124 (from data on Arabic), i.e. 66.9%, and 15 out of 26 (from data on Kurdish), i.e. 57.69% that conform to this pattern⁽¹⁾. These words conform to the principles of the Place Feature Distribution. Examples:

(4)

/ʃiʕibtu:/ (I drank) → /ʕiʃibtu:/
/ðaxabni:/ (He hit me) → /ʕaðabni:/
/ʃaxbaʕit/ (She scribbled) → /xaʃbaʕit/
/xaðra:wa:t/ (vegetables) → /xaðwa:ra:t/
/sadʒaqa:t/ (kind of sweets) → /saqada:t/
/dʊzba/ (Kurdish: day after tomorrow) → /dʊbza/
/di:wa:r/ (Kurdish: wall) → /di:ra:w/
/dargah/ (Kurdish: door) → /dahgar/

A group of 59 examples (from Arabic) and 13 examples (from Kurdish) contained sequences that did not match this pattern, either because both consonants are coronal [+coronal] or both of them are non-coronal [-coronal]. The latter group of words were examined in terms of other place features than [$\pm$ coronal], namely, [anterior]/[posterior] (examples 5- a and b). 20 out of 33 (60.6%) instances from

⁽¹⁾ The calculations made here included only instances that demonstrated place feature differences in the target words. Instances which showed similar place features, i.e. either both are [coronal] or both are [non-coronal], have not been included.

Arabic and 3 instances (out of 6 from Kurdish, i.e. 50%) displayed switching from an [anterior] + [posterior] sequence, to a [posterior] + [anterior] sequence (5: a). 13 words from Arabic (49.4%) and 3 words from Kurdish (50%) displayed switching to the opposite sequence, viz. from [posterior] + [anterior] to [anterior] + [posterior] (5: b).

(5)

a.

/ʕajjibɣad/ (it is cooling) → /ʕajjiɣbab /
 /qamay / (moon) → /qayam /
 /jwaffiq/ (He blesses) → /jwaqqif / (also analogy: he stops)
 /tibki: / (crying- female) → / tikbi: /
 /ʔa:χvi:t/ (Kurdish: speaks) → /ʔa:vχi:t/
 /mʃaʕma:/ (Kurdish: disposable table cloth) → /mʃamħa:/
 /be:zaħmat/ (Kurdish: excuse me) → /be:zamħat/

b.

/hiymi:/ (woman) → / ħimyi:/
 /niʔmal/ (we do/make) → / nimʔal/
 /bali:ʔi:mi:/ (my tonsils) → / bali:mi:ʔi:/
 /ʃħabi: / (you- fem-pull) → /sbħi:/ (also analogy: you- fem, take a bath)
 /dʒa:mʕe/ (Kurdish: mosque) → /dʒa:ʕme/
 /rəbəʕ/ (Kurdish: quarter) → /rəʕəb/ (horror)
 /liffa:ħa/ (Kurdish: scarf) → / lihħa:fa/

Examining the attestation of the sequences resulted from metathesis in the languages in question, viz. Mosuli Arabic and Bahdini Kurdish, has shown that 111 out of 117 metathesis cases influencing consonant clusters (i.e., 94, 87%), are attested in Mosuli Arabic adults' speech; whereas the rest, 6 cases only are rare. This finding is not surprising since there are no strict phonotactic constraints on forming medial clusters in Arabic- Standard and colloquial- any two consonants may combine in these clusters, with very few exceptions involving the sequences, kq, lr, fm, fb, etc. which are not among the permissible sequences in Mosuli Arabic (see Al-Ani, 1970, pp.78-84 and Abdul-Sattar, 1989). The same is much true for Kurdish consonant clusters in medial position (See Ahmad, 1986, and Thackston, 2006). Accordingly, we suggest that young Mosuli and Bahdini Kurdish children are familiar with both, the target and the methathesized sequences and may confuse the correct pronunciation due to uncertainty about the correct sequence in the target word.

The findings of some studies, as reported in Walley (2006, pp. 459), show that word learning and word recognition by children is better for words from sparse rather than dense neighbourhoods, which explains the children's tendency to confuse words that bear phonetic similarity/ analogy to other words in the language.

Geminate consonants in the data (14 instances) are treated as single sounds and are switched over as such, e.g.,

- (6) /tannu:ra/ (skirt) → /tallu:na /
/bat̪ta / (duck) → / ɬappa /
/naʃʃaftu:/ (I rinsed) → / naffaʃtu:/
/ɣimma:n/ (pomegranate) → /miɣɣa:n/

This may provide support evidence for the status of geminate consonants in Arabic, as single long consonants or as double sounds. (See, among others, Ghalib, 1984). It's worth mentioning in this regard that the data from Kurdish showed almost no geminate consonants, except for one case that was noted /liffaħa/ → /liħħafa/ (scarf).

6. Discussion

The answer to the question whether metathesis is a simplification process or not is not a straight forward one. On the one hand, it can be regarded as a simplification process considering the distributional preference for non-coronal sounds to precede coronal sounds. (see examples in 4) On the other hand, the instances whereby the sequences depart from the general sonority sequencing principle, resulting in structures that exhibit maximal decline in sonority rather than a minimal one, suggests metathesis to be not a simplification process. For example, in /dʊzba/ → /dʊbza/ we notice that metathesis results in a sequence whereby the plosive ends the preceding syllable and the voiced fricative initiates the following one, which maximizes the sonority decline. (see examples in 1).

The question whether metathesis is a simplification process at the level of production, perception or representation finds answer in cross-linguistic observations of early child speech. Early child language production points to a strong generalization that only unmarked structures are found in children's first words (e.g., Fikkert,1994; Macken,1979). The claim here is that children in their productions resort to unmarked sounds and structures, such as stopping, fronting, deletion, cluster reduction and difficult sound substitution. However, we notice that in some of the children's

productions there is a noticeable deviation from the unmarked structures toward the marked ones. (see examples in 1: b and 5: b)

The beginnings of words are important for word recognition; therefore, these beginnings are less liable to change or elide. The analysis of the data in our work has confirmed this fact since it revealed that the consonants in the left-edge syllables in these words are preserved, while those in the right-edge syllables are affected by sound reversal. This finding agrees with Locke (1980) who stated that "Syllable position proved to be a powerful determinant of misperception, and that it is apparent that many child substitutions could be predicted *solely* on the basis of adult misperceptions." (p. 199)

As far as production of metathesis is concerned, our subjects showed phonetic variability in their pronunciation of words; i.e. a variety of productions of the same words. When the children were producing some of the words for the first time, their production was characterized by metathesis. However, sometimes, the same word in our data was pronounced correctly in one instance and incorrectly with metathesis in another, for example /farχase:ni/ (Kurdish: serving tray) was produced once as /fayrase:ni/ and at another time, correctly as /farχase:ni/, which supports the claim that child language in its developmental path is not a static process, but rather a dynamic one showing older and newer developments (See Ingram, 1979, p. 41). In these cases, the metatheses were corrected, which makes them more of performance errors.

Form the longitudinal observation, however, we also found some of the productions to persist and become fossilized in the children's speech, which suggests that the child's production of metathesis has its roots in the representation level. This is supported by some examples, such as /ʃikka:χa/ (fork) which persisted in the speech of one of the subjects as /ʃixχa:ka/ even at 8 years of age. The assertion that metathesis has its roots at the representation level is further supported by the fact that the metathesized form of the word /nəʃmal/ (we make/do) continued to be pronounced by another subject and even displayed derivational representations as /nəmʃal/, /ʔəmʃalna/ (we did/made), /ʔamʃal/ (I do/make), and /ʔəmʃali:li/ (you-fem- do/make for me).

Form a different angle, consonant clusters in Arabic, including Mosuli Arabic, and in Bahdini Kurdish to a certain extent, are heterogeneous in nature in that there are no, or at best very few strict constraints on the distribution of consonants within the cluster, at least as far as medial clusters are concerned; any two consonants may combine to make a cluster, with few exceptions (see Al- Ani, 1970; Abdul-Sattar, 1989; Ahmad, 1986). This leads to the conclusion that young children are familiar with

reverse sequences and may confuse the correct pronunciation due to uncertainty about the heard sequence, or the received signal, as is argued by Hume (2001).

Perception is constrained by one's sense of phonological structure and lexical expectations (Oller and Eilers, 1975). Furthermore, "as perception and organization are also influenced by speech production capabilities, it may be difficult to prove that any sound change is motivated purely by a single component of the total process" (Fukazawa and Miglio, 2008:32). The fact that children are unable to produce certain sound sequences correctly at an early age is mainly ascribed to their insufficient ability to fully co-ordinate the movements of their vocal system (apparatus) because "certain sounds, sound combinations and transitions from one sound to another may be currently too difficult." (Williamson, 2010, p. 1)

Drawing on the evidence from Universal Grammar the data analysed in this study have demonstrated that Syllable Contact Law (relying on the sonority of the sounds in the sequences) and Place Feature of resultant sequences do not provide conclusive evidence for dealing with metathesis as a simplification process associated with the child's limited articulatory ability. However, the other criteria, namely, the attestation of resultant sequences in the language (viz. Mosuli Arabic and Bahdini Kurdish) and the occurrence of phonological analogy have proved to be more solid. The resultant sequences have shown high percentages of occurrence in Mosuli Arabic (94.87%), but lower percentage in Kurdish (only 21.95%). This finding entails the children's familiarity with both distribution structures of the sounds in these sequences. Furthermore, difficulties in production may be taken as a definite factor underlying the occurrence of metathesis; it is rather, the difficulties/problems of misperception of the correct sequences where both are among the language input. Hume (2001, 2004, and 2007) provides the term "Indeterminacy" to account for synchronic metathesis in adults' phonology because of the complexity of the acoustic signal. We are prone to rely on this and take "indeterminacy" as a candidate factor that leads to metathesis in child phonology (see also Fukazawa and Miglio, 2008). According to Walley (2006), there is empirical evidence that suggests children's word recognition is holistic in character rather than analytical like that of adults. This has its consequences on children's recognition of words from dense and sparse neighbourhoods. Thus, children are better able to recognize words from sparse neighbourhoods than ones from dense neighbourhoods (ibid). This matches well with our findings in that some of the children's metathesized forms are words already existent in the language, e.g.,

/masbaħ/ (swimming pool) for /maħbas/ (ring), /tappa / (a ball) for /batta/ (a duck), etc. (see examples in 2).

To sum up, difficulties in production cannot be the only and main reason behind metathesis in child phonology; other factors have parallel influence on this process, such as indeterminacy and/or misperception.

7. Conclusions:

In this study, metathesis in child phonology has been demonstrated to be a systematic process, rather than a random or sporadic error. Through analysis of spontaneous speech data from children acquiring Mosuli Arabic and Bahdini Kurdish, we have identified regular and recurring patterns in the reordering of segments, especially in consonant clusters and syllable-boundary environments. These patterns reflect underlying phonological strategies employed by children to simplify complex structures during early stages of language development.

Importantly, the data suggest that metathesis functions not only as an articulatory simplification mechanism but also as a result of processing limitations—particularly in speech perception and word-form recognition. Children's developing perceptual systems may incorrectly interpret or retain the linear sequence of sounds, which later manifests as production-based metathesis.

Our findings also underscore that no single explanation—be it articulatory, perceptual, or morphological—can fully account for the occurrence of metathesis in child phonology. Rather, it is a multi-factorial phenomenon shaped by the interaction of phonological knowledge, perceptual development, and language-specific structural features.

Given these insights, we recommend that future research include experimental studies focusing on children's perception of both metathesized and target word forms. Investigating how young speakers of different languages identify, distinguish, or prefer certain forms over others will contribute to a more comprehensive understanding of the cognitive and phonological mechanisms underlying metathesis.

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